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6. The method of claim 1, wherein the controlling further comprises stopping enhancement of the adhesion by causing a temperature difference between the substrate and the material such that a temperature gradient stops the enhancement of the adhesion.

A Comparison document, showing additions to the claims with underlining and deletions with bracketing, is attached.

REMARKS

Claims 1-4, 6-28 and 43-46 are pending. Claims 29-42 were previously withdrawn from consideration. By this amendment, claims 1 and 6 are amended, and claim 5 is cancelled.

Claims 1-28 and 43-46 were rejected under 35 U.S.C. § 112, first paragraph, for allegedly containing subject matter not described in the specification. In particular, the Examiner asserts that the specification lacks support for the claimed feature that the material includes individual particles and the step of sintering includes completely sintering the individual particles within the material together. Applicants respectfully disagree.

The Background portion of Applicants' specification discusses how continuity in materials used for electrical devices requires that individual particles be sintered into one conjoined structure. See page 1, last paragraph of the specification. The Background further mentions that this continuity requires high temperatures. As noted at page 2 of the specification, the construction of electrical components with a high melting point on a substrate with a low melting point presents a difficult challenge. The specification further notes that a need exists for protecting a substrate from laser damage during the laser sintering process. From these passages, it is clear that one of the problems to be solved by the invention is the sintering of particles within a material together.

The Summary portion of the specification describes how these problems are addressed. The Summary describes how the invention allows sintering to occur throughout the material. See page 2, second full paragraph. The Summary further describes how electronic materials may be

sintered into functioning components without damage to the substrate. See page 3, first full paragraph.

Applicants respectfully submit that one skilled in the art would know that materials used in constructing electronics include individual particles, as discussed, e.g., in the last paragraph on page 1 of the specification. Further, given that the sintering of particles together is one of the problems addressed by the invention, Applicants respectfully submit that one skilled in the art, having Applicants' specification before him or her, would realize that the references to "sintering throughout the material" in the Summary and at various other portions of the specification refer to sintering of particles together. Accordingly, Applicants respectfully submit that the requirements of 35 U.S.C. § 112, first paragraph, are met.

Claims 1-10, 12, 14, and 15 were rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,451,387B1 to Wadman ("Wadman"). Claims 1-3, 7-16, and 21-23 are 10, 13, 14, 21, and 22 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 4,151,008 to Kirkpatrick ("Kirkpatrick") in view of U.S. Patent No. 5,746,868 to Abe ("Abe"). Claims 1-6 were also rejected under Section 103(a) as being unpatentable over U.S. Patent No. 5,223,453 to Sopori ("Sopori") in view of Abe. Claims 17-20 and 43-46 were rejected under Section 103(a) as being obvious over Kirkpatrick in view of Abe and U.S. Patent No. 6,100,463 to Ladd et al. ("Ladd"). Claims 24-28 were rejected under Section 103(a) as being obvious over Kirkpatrick in view of Abe and U.S. Patent No. 6,300,256B1 to Kriegel et al. ("Kriegel"). These rejections are respectfully traversed.

According to exemplary embodiments, a technique is provided for laser sintering of particles in a material into a conjoined structure and for enhancing adhesion of the material to a substrate without damaging the substrate. According to one embodiment, adhesion of the material on the substrate is controlled by maintaining a similar temperature between the substrate and the material. Eliminating a temperature gradient between the substrate and the sintered material enhances adhesion.

For example, claim 1 recites a sintering method comprising providing a material including individual particles on a substrate, completely sintering the individual particles within

the material together on the substrate, and enhancing adhesion of the material to the substrate without damaging the substrate. Although not considered necessary to overcome the cited patents, claim 1 has been amended to expedite prosecution to recite features formerly recited in claim 5. In particular, claim 1 has been amended to recite that the adhesion of the material on the substrate is controlled by maintaining a similar temperature between the substrate and the material for enhancing adhesion. Claim 6, which formerly depended from claim 5, has been amended to depend from claim 1.

The Action initially relies on Wadman for all the features formerly recited in claim 5 and now recited in claim 1. In particular, the Action asserts that in Wadman, when heating the substrate at the surface, no thermal gradient exists between the ceramic layer and the substrate, and the adhesion between the two is increased. However, Applicants can find no basis for this statement in Wadman. In one embodiment of Wadman, a laser is focused on the ceramic particles at a wavelength adjusted to the energy-absorption power of the ceramic particles. See col. 2, ll. 26-42 of Wadman. Heat penetrates the ceramic layer and heats the under-layer. See col. 2, ll. 56-57. In another embodiment of Wadman, a laser is focused on the surface layer of the under-layer at a wavelength adjusted to the absorption power of the under-layer. See col. 2, l. 64 through col. 3, l. 2. The ceramic particles are incorporated into the metal surface layer of the under-layer. See col. 3, ll. 2-4. Nowhere in Wadman is there a disclosure or suggestion of controlling adhesion of a material on a substrate by maintaining a similar temperature between the substrate and the material for enhancing adhesion as recited in amended claim 1. In fact, in both embodiments of Wadman, the ceramic layer and the under-layer are heated differently. Also, the ceramic layer is made of a different material than the synthetic resin under-layer and the different material have different properties and absorb energy and dissipate heat differently. This will result in a significant thermal gradient between the ceramic layer and the under-layer. Therefore, Applicants respectfully submit that Wadman fails to disclose all the recited in amended claim 1, and claim 1 is considered allowable over Wadman.

The Action also relies on a combination of Sopori and Abe for the features formerly recited in claim 5 and now recited in claim 1. Sopori discloses a sintering/alloying process using

one-directional reverse illumination. In Sopori, metal strips deposited on a top surface of a semiconductor substrate are sintered at one temperature simultaneously with alloying a metal layer on the bottom surface at a second, higher temperature. See Abstract of Sopori. To accomplish this, infrared radiation is directed through the top surface to the interface of the bottom surface with the metal layer. This radiation is absorbed to create a primary hot zone with a temperature high enough to melt and alloy the metal layer with the bottom surface of the substrate. Heat conducts through the substrate from the primary hot zone, and heat is created by infrared radiation reflects from the metal layer to the metal strips. Also, heat is created from some primary absorption by the metal strips. All this heat is combined to create secondary hot zones at the interface of the metal strips with the top surface of the substrate. The Action asserts that Sopori's teaching of hot spots and secondary hot spots shows that the temperature of the substrate and the top material, at the interface, are similar during radiation. However, nothing about Sopori's description of primary and secondary hot spots suggests that adhesion of the metal strips to the semiconductor substrate is controlled by maintaining a similar temperature between the semiconductor substrate and the metal strips. Moreover, the semiconductor layer and the metal strips have different properties that react to heat differently. Also, the semiconductor and the metal strips are heated quite differently. Thus, Applicants respectfully submit that in Sopori there is a significant temperature gradient between the semiconductor substrate and the metal strips.

Like Sopori, Abe also fails to disclose or suggest controlling adhesion of a material on a substrate by maintaining a similar temperature between the substrate and the material for enhancing adhesion as recited in amended claim 1. Accordingly, amended claim 1 is considered allowable over any combination of Sopori and Abe.

Applicants respectfully request that if the position is maintained that the features formerly recited in claim 5 are shown in Wadman and/or Sopori, it be specifically pointed out where in each patent there exists a basis for this view.

Claims 2-4, 6-28 and 43-46 depend ultimately from claim 1 and are considered allowable for at least the same reasons.

For the foregoing reasons, claims 1-4, 6-28 and 43-46 are considered allowable. A Notice to this effect is respectfully solicited. If any questions remain, the Examiner is invited to contact the undersigned attorney at the telephone number given below.

Respectfully submitted,

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CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: MAIL STOP AF, Commissioner for Patents, Washington, D.C. 20231, on the date indicated below.

Jennifer Pearson Medlin

4/24/03
Date

COMPARISON OF CLAIMS

1. A laser sintering method, comprising providing a material including individual particles on a substrate, completely sintering the individual particles within the material together on the substrate, and enhancing adhesion of the material on the substrate without damaging the substrate, wherein adhesion of the material on the substrate is controlled by maintaining a similar temperature between the substrate and the material for enhancing adhesion.

[5. The method of claim 4, further comprising controlling adhesion of the material on the substrate by maintaining a similar temperature between the substrate and the material for enhancing adhesion.]

6. The method of claim [5] 1, wherein the controlling further comprises stopping enhancement of the adhesion by causing a temperature difference between the substrate and the material such that a temperature gradient stops the enhancement of the adhesion.